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COMPARATIVE STATISTICS OF RAILROAD RATES.

BY HENRY H. SWAIN, PH.D.

In studying financial statistics of railroad operation it is a task of almost overwhelming magnitude to compare each item of a freight schedule or a passenger tariff with corresponding items in earlier or later schedules, and so diverse would be the results of such comparisons, if accomplished, that generalization in regard to the course of rates would be almost impossible. When comparisons are undertaken between different sections or countries, the task is even more complicated, and any generalization is rendered almost impossible by the lack of correspondence between the different items of the schedule. It has therefore become a matter of great interest to statisticians to find some method of averages by which freight or passenger rates can be compared in different periods or different places. It is commonly assumed that the problem has been solved in the "ton-mile" or "passenger-mile" statistics now in very general use.

These statistics are compiled in the following manner: Each shipment of freight is reduced to the basis of one mile; for example, a consignment of twelve tons carried ninety miles is expressed as equivalent to 1080 tons carried one mile; all the shipments, after being reduced to this basis, are added together; thus all the freight transported on railroads in the United States in the year ending June 30, 1896, was equivalent to 95,328,360,278 tons transported one mile.* For transporting this freight the railroads received $786,615,837.† Dividing this sum by the number of tons we find that the revenue per ton-mile was .806 cent.‡

Similarly, if a passenger travels 983 miles it is counted as equivalent to 983 passengers travelling one mile. All the journeys of all the passengers are added, and we find that there were in the year 1895–96, 13,049,007,233 passengers carried one mile in the United States.§ The railroads received for this service $266,562,533.|| Consequently, by a process of division, we get 2.019 cents as the revenue per passenger-mile.¶

Such calculations as this have about them a charm of simplicity, and if a change in the rates were the only cause which could occasion a variation in the average, this method would be as satisfactory as could be desired. That these averages really are conclusive is assumed quite widely by writers on railroad statistics. From among a multitude of possible illustrations it may suffice to quote two or three at random. The president of the Santa Fé system, in a memorial to the Kansas legislature, published in the *Railway Age* of Feb. 12, 1897, declares that his railroad has been steadily reducing freight rates in Kansas, and in proof of this he shows that the rate per ton-mile, Dec. 31, 1882, was 2.288 cents, and June 30, 1896, 1.028 cents, "making a decrease from 1882 to 1896 of 55.07 per cent." *The Eighth Annual Report of the Interstate Commerce Commission* sets forth on page 228 tables of ton-mile and passenger-mile statistics from various countries designed to show that rates in the

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* *Ninth Annual Report on the Statistics of Railways*, p. 59.

† *Id.*, p. 343.

‡ *Id.*, *ib.* The correct quotient would seem to be .825.

§ *Id.*, p. 59.

|| *Id.*, p. 342.

¶ *Id.*, *ib.* Apparently it should be 2.043 cents.

United States are the "lowest in the world." The Senate Finance Report on *Wholesale Prices, Wages, and Transportation* gives a table showing the number of cents per ton-mile received for freight transportation by certain railroads in 1860 and in 1892, and this comment follows: "For the dates named this table gives a very interesting and instructive comparison. It shows a very great reduction in freight rates." The same report declares on page 614 that "no presentation of the tendency toward lower charges for freight transportation by railways is at once so comprehensive, accurate, and readily understood as a statement of the average charges per ton per mile prevailing during successive periods."

President Ripley doubtless knows whether freight rates in Kansas have been reduced in late years, though his figures fail to throw any light on the subject. It is not the purpose here to enter on the controverted question whether American rates are higher or lower than in some other countries, nor to deny that freight rates in the United States may have fallen somewhat during a period whose most marked economic characteristic has been the universal fall in general prices. But an effort will be made to show that no presentation of railroad charges is at once so misleading, inaccurate, and certain to be misunderstood as a statement of the average charges per ton per mile prevailing during successive periods. The demonstration is not difficult. It consists only of showing that the "average" rate is a resultant of several causes, and that a change in any one of these causes is quite capable of modifying the average most profoundly; in consequence it is utterly illogical to select arbitrarily a single one of these causes and attribute all fluctuations in the average solely to variations in rates.

To begin with freight rates: If all the freight transported between any two points were taken at a uniform rate regardless of the character of the commodity the case would be marvellously simplified. But as a matter of fact there are almost as many different rates as there are kinds of goods. To make it easier to grasp the case, however, we will suppose all freight to be grouped into five classes, and in the case of two railroads of equal length the rates on each road between its termini are precisely the same, *viz.:* —

First Class	60 cents per cwt.
Second "	45 " " "
Third "	35 " " "
Fourth "	30 " " "
Fifth "	20 " " "

Is it not evident that, although the rates are precisely the same on the two roads, the revenue per ton-mile may be very different on the two, and that it cannot possibly be the same unless the proportion of each class of freight carried by both roads is precisely the same? Suppose, for example, that one of the termini of one road is at the center of the production of some staple commodity included in Class 5, while the other road handles little 5th class freight, except what is going to consumers along its line, is it not plain that, other things being equal, the revenue per ton-mile will be much less in the case of the first road than in the case of the second? Or, if we confine our attention to a single road at different periods it is perfectly obvious that any industrial change which increases the relative proportion of low class freight handled lowers the revenue per ton-mile, and any increase in the proportion of high grade freight raises the revenue per ton-mile, rates remaining precisely the same.*

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* *The Senate Finance Report* (vol. 1, p. 43,) shows the per cent of tonnage in each class forwarded by the trunk lines from New York to and beyond the western termini in : —

	1889.	1892.
Class 1	22.2	19.9
" 2	6.9	5.4
" 3	12.8	11.3
" 4	13.0	10.4
" 5	7.8	9.6
" 6	37.3	43.4
	100.0	100.0

Here is a variation of nearly eighteen per cent in three years in the relative proportion of 5th and 6th class to higher grade freights,— a variation which is utterly ignored by the *Report* when rates are being considered.

But the cent-per-ton-mile theory assumes that a change of rate is the only cause which can make a variation in the revenue per ton-mile, and that therefore a rise or fall of the revenue per ton-mile is conclusive proof of a corresponding rise or fall of rates.

But this is only half of the story. We have confined our attention to traffic between the termini alone. Now let the way stations be inserted. It costs just as much to load and unload freight for a journey of five miles as for a journey of five hundred miles. Consequently, if a railroad company charged for freight going five miles only the bare cost of loading and unloading, and then charged one hundred times as much for transporting freight 500 miles, the latter rate would be prohibitive of almost all traffic over the longer distance. No railroad manager would think of making such a charge. In general, the longer the distance a consignment of freight is to travel the less per mile is the charge.

Now disregarding, for the sake of simplicity, the complexities of "classification," let us suppose two roads of equal length, with way stations similarly located along each, and the freight rates between any two stations on the one precisely the same as between the corresponding stations on the other. But let us assume that in one case the greater share of the business passes over the whole length of the road from one terminus to the other, but in the case of the second a greater share of the business is between the way stations. Other things being equal, it must be obvious that the revenue per ton-mile of the first road will be less than that of the second, although rates are precisely alike on both. Or, in the case of a single road over a period of time, an increase in the "way" traffic relative to the "through" business will increase the revenue per ton-mile, rates remaining just the same. But the theory under consideration necessarily implies that a change of rates is the only thing that can cause a change in the revenue per ton-mile, and that an increase or decrease in the revenue per ton-mile is of itself conclusive proof of a corresponding increase or decrease of rates.

With slight modifications the same explanation applies to passenger business. While most of the travel in America is "first class," there are some "second class" and "emigrant" rates, and many circumstances under which a lower fare is charged on account of stricter limitations as to time. Consequently, the schedule of charges remaining precisely the same, the revenue per passenger-mile will be less the greater the proportion of passengers who travel second class or on the occasion of excursions or with mileage books.

Furthermore, as to distance, though for a different reason than in the case of freight, the fare for a very long ride is usually somewhat less per mile than for a short ride, with one exception. In the immediate environs of large cities the elasticity of demand for short distance travel is very great. Consequently, railroads favorably situated find it profitable to make such fares lower proportionately even than the charge for very long distances. We may divide passenger traffic roughly then into local, long distance, and suburban. The rates in each class remaining absolutely unchanged, the revenue per passenger-mile will be greater the shorter the average journey, except that an increase in the proportion of suburban travel lowers the revenue per passenger-mile.* But the statistical theory in question assumes it as self-evident that a change of rates must be the only cause that can possibly change the revenue per passenger-mile, and that therefore an increase or decrease of the revenue per

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* The statistical report of the Interstate Commerce Commission gives these figures for the average journey travelled per passenger for a series of years. The tendency to increase is noticeable, though for reasons which cannot be detailed here the figures are absolutely much too small : —

Year.	Miles.	Year.	Miles.
1890 . . .	24.06	1894 . . .	26.43
1891 . . .	24.18	1895 . . .	24.02
1892 . . .	23.82	1896 . . .	25.50
1893 . . .	23.97		

passenger-mile is unassailable proof of a corresponding increase or decrease of passenger fares.

Finally another specific instance will show graphically the utter impossibility of discovering anything about the difference in rates between different roads or different years on the basis of any passenger-mile statistics. The city of Madison, Wisconsin, is connected with Chicago by three different railroads on each of which the fare between the two points is exactly the same and has been unchanged for a considerable number of years. But when we examine the data upon which the statistics of passenger revenue are based we find the utmost complexity. As the conductor goes through the train he finds at least six different sorts of tickets presented by passengers occupying the same car from Chicago to Madison. First there is the occasional passenger whose ticket has cost him $3.92. There is the clergyman with his "permit" who has paid $1.96 for the ride. There is the man who goes back and forth four or five times a year and has paid $25 for a thousand-mile ticket; the trip costs him $3.45. There is the man always "on the road" whose two thousand-mile book has cost him $40 net, the proportion of which applied to this trip amounts to $2.76. If it is summer there are the Chicago people going to the country for an outing with round-trip tickets each half of which cost $3.13, or if they are to return the next Monday, only $2.63. Each of these different forms has been available regularly for several years at exactly the prices named and on each of several different roads. But it must be perfectly manifest that the revenue per passenger-mile may be most radically changed by any circumstances which affect the relative proportions of these different sorts of travel to one another.

So much for one factor in the revenue per passenger-mile, the money paid. Now for the other factor, the miles travelled. The distance from Chicago to Madison by one road is 176 miles, by another from 131 to 164 miles, according to the train taken,* and by the other from 166 to 181 miles, according to the route.† Now as the fare is just the same whichever route is taken,‡ and as there are nine different routes, each of a different length, by which regular passenger trains are run every week-day in the year, it must again be evident that the revenue per passenger-mile will depend on the proportion of the travel which goes by the different routes. It will be less on the Illinois Central than on the Northwestern, since that route is the longer. It will vary on the Northwestern and the St. Paul roads from year to year according as any slight changes of time-tables or other causes serve to make some trains more generally convenient than other trains for this particular travel.

To sum up, differences in the average receipts per passenger per mile or per ton per mile may be due to differences in the rates, or to either one of two other sets of independent causes, or to any possible combination of these. It is therefore impossible to determine, from comparisons of ton-mile or passenger-mile averages, anything whatever in regard to the differences in freight or passenger charges.

Remarks by Henry C. Adams.

The remarks by Dr. Swain upon the passenger-mile and ton-mile unit in railway statistics present in a very forceful manner a truth which none deplore more than those who are obliged to work constantly with this class of statistics. The difficulty to which he refers does not, however, so much lie in the imperfect character of the unit as in the fact that, up to the present, railway reports fail to separate

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* Distance from Chicago to Madison on the Chicago & Northwestern Railway via the routes taken by trains —

"Nos. 3 and 5"	131 miles.
"No. 1"	138 "
"No. 7"	145 "
"No. 9"	153 "
Trains running via Milwaukee	164 "

† Distance from Chicago to Madison on the Chicago, Milwaukee & St. Paul Railway

Via Watertown	168 miles.
Via Whitewater	181 "
Via Rockford	166 "

‡ This is true even if one uses mileage books, as the conductors take up the same amount of mileage for the trip, whatever train one happens to travel on.

their traffic and earnings on the basis of the kinds of freight and classes of passengers carried. This has for some time been within the purpose of the Federal and the State Railroad Commissioners. Indeed, a plan for the classification of freight revenue was at one time accepted, but the late depression of railway earnings led to the postponement of its execution. It is quite possible, now that prosperity has returned, that another effort will be made to analyze receipts per ton per mile, and receipts per passenger per mile, in such a manner as to make them much more significant than they now are.

It may be doubtful if any statistician would consent to the abandonment of the ton-mileage and passenger-mileage unit, nor do I understand that such is the purpose of Dr. Swain's criticisms. This unit has received the approval of the *Institut International de Statistique*, and is adopted in the reports of all important countries with the exception of England. Progress certainly lies in the development of the unit rather than in its abandonment. The matter of international comparisons is a most difficult one. Within the past ten years there have been at least two attempts to establish uniformity in the railway statistics of Europe, but nothing very definite has been accomplished. For some reason the project fails to interest those who administer the French railways, and without France it has not been thought expedient to press the proposal. Should it be again undertaken, and the idea is by no means abandoned, the Interstate Commerce Commission has received assurances that the United States will be invited to take part in the conference. Meantime, and in the absence of any better unit of comparison, it seems wise to retain the ton-mileage unit, and to undertake its development so as to obviate the criticisms that may justly be made upon it.

It may be proper to say a word respecting the apparent discrepency, to which Dr. Swain calls attention, between the receipts per ton per mile and per passenger per mile as reported by the Interstate Commerce Commission and as arrived at by dividing the aggregate of reported receipts by the aggregate of reported traffic.

The rule adopted by the Commission for computing averages is to exclude from the aggregates made use of all figures returned in reports that are not in all respects complete and satisfactory so far as the item under consideration is concerned. To illustrate, from the case in hand, some roads may return freight receipts but not tonnage; some may return freight receipts and tonnage but not ton-mileage; some may return tonnage and ton-mileage but not receipts. The averages which appear in the Statistics of Railways are computed from balanced and satisfactory returns. It is thought by this means to arrive at a statement more nearly correct than by the other method of computation. It should be added, however, that there is no considerable number of unbalanced returns.

Remarks by Arthur T. Hadley.

All careful students of railroad economy will sympathize with Prof. Swain in his protest against the abuse of ton and passenger-mile statistics. But many of them will consider that, in his zeal against their abuse, he has gone so far as to deny their legitimate use; and will stop far short of his conclusion that it is "impossible to determine from comparisons of ton-mile or passenger charges *anything whatever* in regard to differences in freight or passenger charges."

What Prof. Swain has proved thoroughly is that variations and differences on the average receipt per passenger-mile or per ton-mile are not necessarily accompanied by corresponding variations and differences in the tariff schedules of the roads concerned. What his opponents may perhaps fairly claim is (1) that, taking charges on the same road in different years, the correspondence between average rates and tariff schedules is in practise very much closer than Prof. Swain's paper would lead us to suppose; (2) that in comparisons between different roads it is possible to make abstraction of the more important disturbing elements in such a way as to guard against the abuses which Prof. Swain so justly condemns; (3) that for many purposes the average actual receipt is a more important basis of comparison than the tariff schedule.

I shall confine my discussion to the last point, which is least obvious and most important.

It is assumed in Prof. Swain's paper that if two railroads have the same tariff schedule they are charging the same rates. From one standpoint this is obviously true; from another standpoint it is, to say the least, an extremely doubtful proposition.

If one road is getting nearly all high-class freight and another is getting a great deal of low-class freight the first is actually receiving higher average rates than the second. If one road gets all the ministers, and another gets all the commercial travellers, and a third gets all the excursionists, it is fair to say that they have different average rates for their services. The character of the business done by a railroad is not a matter of accident. It is largely dependent upon traffic management. The company that has developed low-class traffic is entitled to credit for its efforts. Of course low-class traffic is far easier to develop in some districts than in others. A man who builds a road into a region which is unfavorably constituted in this respect has his choice between two courses. He can content himself with doing high-grade business and avow that he charges high rates because his services are valuable ; or he can make the extraordinary efforts needed to develop the low-grade business in his locality. In the absence of the latter alternative he must accept the former.

A road is to be judged by the business that it does, rather than by the business that it doesn't do. The ton-mileage statistic, rough as it is, has at least the merit of dealing with traffic actually handled. The tariff-schedule comparison, plausible as it seems, has the demerit of giving disproportionate weight to traffic which is *not* actually handled. The ton-mileage comparison has many sins to answer for; but this particular sin of not conforming to the tariff-schedule comparison seems often to be a virtue rather than a vice.

Remarks by Emory R. Johnson.

Statistical data used for comparison should be carefully analyzed in order to make sure that the data compared are accurate and comparable. In his paper on " Comparative Statistics of Railroad Rates " Dr. Swain has done well to call attention to the factors that affect the ton-mile and passenger-mile earnings of railroads,— the unit of most significance in the comparisons made in railway transportation statistics.

The statement made by Dr. Swain that ton-mile and passenger-mile averages are influenced by several factors is true, but is neither new nor startling. I do not know that the persons whose scientific attainments give them a right to be heard have ever claimed that " change of rates is the only thing that can cause a change in the revenue per ton-mile." Dr. Swain has indeed enumerated only a few of the many causes influencing the ton-mile revenue of the railroads. The revenue per ton-mile depends not only upon the character of goods and upon distance travelled, but also upon the amount of goods carried, the season at which they are moved, the character of the road, whether it be a level one or one containing curves, the proportion which the traffic one way bears to that moving the other, the relation of dead weight to load, and upon many other factors well known to the practical railroad man and the student of transportation.

The criticism which Dr. Swain offers as to making comparisons of ton-mile and passenger-mile earnings of different periods, to indicate the fall which railroad charges have undergone, has some force when the comparisons made are those between the earnings for different periods of a single railway company or railroad system. It is quite possible that the character of the business done by a particular road, or the conditions under which the business is performed, may so change as to make the ton-mile and passenger-mile averages of one period the resultant of factors appreciably different from those which determine the averages of another period. It would, however, be somewhat difficult to show that any very radical change has taken place during the past ten or fifteen years in the character of the business done by such a system as the Atchison.

When, however, Dr. Swain says that "no presentation of railroad charges is at once so misleading, inaccurate, and certain to be misunderstood as a statement of the average charges per ton per mile prevailing during successive periods"; and when he declares that it is "impossible to determine, from comparisons of ton-mile or passenger-mile averages, anything whatever in regard to the differences in freight or passenger charges" he makes a statement that is not only exaggerated but inaccurate. The ton-mile and passenger-mile earnings of the railways of the United States as a whole are excellent general averages. It would be difficult to find many better general averages in statistics. There are over a thousand operating railway companies, and the kinds of goods carried number several thousands. The average earnings per ton per mile of this large number of companies engaged in the movement of this great variety of commodities presents a general average whose excellence appeals to every statistician. The Senate Finance Report on *Wholesale Prices, Wages, and Transportation* makes an essentially accurate statement when it declares that "no presentation of the tendency towards lower charges for freight transportation by railroads is at once so comprehensive, accurate, and readily understood as a statement of the average charges per ton per mile prevailing during successive periods."

Dr. Swain's paper contains a wholesome protest against the kind of reasoning often indulged in by interested parties that have a thesis to prove regarding railway charges; but as a criticism on the utility of the ton-mile and passenger-mile earnings of the railways, as units for the measurement of the course of railway charges, much of the paper is, to say the least, misleading.

Remarks by H. T. Newcomb.

Dr. Swain's contribution to the study of railway rates is an excellent example, though graciously devoid of the spirit of malice too often noticed, of a form of criticism to which statistical work is frequently subjected, which consists principally in assuming that an unattainable object has been sought and condemning the failure to succeed in accomplishing a task that was not and should not have been attempted. Statisticians, practicing a modesty which they share with all who wish to deal with facts in a scientific manner, do not commonly assume that many problems have been "solved" by their method, and those among them who have delved in the facts which pertain to railway transportation do not assert, as Dr. Swain too boldly intimates in his opening paragraph, that absolutely accurate or entirely satisfactory comparisons among railway rates are practicable. Those who are accustomed to seek accuracy of expression, whether by means of figures or the careful choice of words, will perceive some difference between the conclusion that: "It is therefore impossible to determine, from comparisons of ton-mile or passenger-mile averages, anything whatever in regard to the differences in freight or passenger charges," and the "not difficult" demonstration which consists in showing that such averages are somewhat affected by variations in factors other than rates that results from the preceding effort "to show that no presentation of railway charges is at once so misleading, inaccurate, and certain to be misunderstood as a statement of the average charges per ton per mile prevailing during successive periods."

The real question is not whether there are such variations, but whether they are sufficient materially to affect the averages. It may be perfectly true, as stated by Mr. McCain in the report of the Committee on Finance of the Senate on *Wages and Prices*, that: "No presentation of the tendency toward lower charges for freight transportation by railways is at once so comprehensive, accurate, and readily understood as a statement of the average charges per ton-mile prevailing during successive periods," even though there is a possible margin of error in such a statement due to several causes including those noticed by Dr. Swain. No fact in statistics is more commonly recognized than that the death rate of a particular community is in some degree affected by the age distribution of those composing it, yet statisticians do not believe that comparisons among crude death rates fail to throw some light upon the relative healthfulness of different communities. The variations in the factors which independently of changes in rates may effect variations in the averages per ton-mile probably affect the latter even less than death rates are affected by variations in age distribution. They might modify the average "most profoundly," but in practice they do not, and the propriety of attributing to variations in rates, the fluctuations in ton-mile averages, so far as to claim that the latter throw valuable light on the former, is far less a question of logic than one of fact.

The comparative unimportance of the variations in ton-mile averages which result from fluctuations in the relative quantities of freight in the different classes may be shown by applying actual rates and distances to the figures showing the percentage of tonnage in each class during 1889 and 1892 quoted from the report of the Committee on Finance in a foot-note to Dr. Swain's paper as follows: —

Class.	Per cent of tonnage.		Rates. New York to Buffalo. per 100 pounds.	Per cent of tonnage multiplied by rate.	
	1889.	1892.		1889.	1892.
1	22.2	19.9	39	865.8	776.1
2	6.9	5.4	33	227.7	178.2
3	12.8	11.3	28	358.4	316.4
4	13.0	10.4	19	247.0	197.6
5	7.8	9.6	16	124.8	153.6
6	37.3	43.4	13	484.9	564.2
	100.0	100.0		2,308.6	2,186.1

According to the foregoing the average rate per ton of freight from New York to the Trunk Line termini was $4.62 in 1889 and $4.37 in 1892, and the average rate per ton per mile on the basis of the distance between New York and Buffalo was 1.049 cents in the former and 0.994 cent in the latter year. Though the difference of one-half of a mill would scarcely vitiate the comparison even if the result of causes entirely independent of fluctuations in rates, it is not, as Dr. Swain has rather hastily assumed, the consequence of changes in the character of shipments, for the increased percentages in the lower classes in 1892 were caused by modifications in the classification of freight which, between 1889 and 1892, had transferred many articles to the lower classes. This was fully explained in the report together with the fact that changes in classification result in actual changes in rates.

The other sources of error indicated are not more important. In accordance with the same law which determines that in an extensive community there will be during equal periods approximately the same number of murders and suicides, the passengers of the country purchase during different years about the same relative proportions of the different classes of tickets, and shippers forward different commodities in quantities varying, with regard to each other, even less. It is to be observed that the article does not cite a single fact which tends to establish the relative probability of changes in the averages being due to the several causes which affect them.

All those who have studied the subject are aware of the conditions which limit the rate per ton-mile and passenger-mile averages and wish to see the classification of railway statistics extended until it will be possible to give such averages separately for different classes of traffic. It is desirable, for example, to have the average rate per passenger mile for passengers travelling on each of the great classes of tickets. Both passengers and freight should also be classified as local or through traffic, according to their general direction and according to the distance traversed. Before these data can be secured, however, there must be a considerable development of railway accounting, and in the mean time statisticians will be obliged, as they are in connection with many other problems, to be satisfied with the best results that can be obtained under limiting conditions which they recognize and regret.

It should be remarked that the criticism of the report of the Statistician to the Interstate Commerce Commission, implied by the foot-notes calling attention to the differences between the average rates per passenger and per ton per mile reported, and the actual quotients obtained by dividing passenger revenue by passenger-miles and freight revenue by ton-miles, is not well founded. The reports on Railway Statistics very properly give the aggregate of revenue and of passenger and freight mileage for all railways which report any of those items, but before obtaining the averages it is always necessary to deduct the revenue of roads which do not report their passenger or freight mileage.

Remarks by C. E. Prevey.

In this article two problems appear to be involved: First, the mathematical question which lies on the surface, whether or no a decline in the average receipts per ton or passenger-mile necessarily implies a reduction of rates; and, second, an ethical question regarding the fairness of rates, which is implied in the treatment of the subject. Considering first the mathematical question, we cannot agree with the writer of the article in giving a negative answer. We should answer the question as just stated in the affirmative, and for the following reason: By a reduction in rates we can mean nothing else than average rates. We cannot mean individual rates for the shipment of a given class of goods over a given piece of road, because these are too numerous and too fluctuating to be compared, and the only thing that can be compared is the *average* amount received for the shipment of a ton of freight one mile, which is found by dividing the total freight receipts by the number of tons carried one mile. This average amount may be lowered by the reduction of tariff rates or by an increase in the relative amount of low-class freight shipped, the schedules remaining the same. The latter is as truly a reduction in average freight rates as the former.

The writer gives a number of examples showing how the average rate may be lowered while the schedule of rates or tariff remains the same. Perhaps the following table will help to make clear the relation of these factors: —

FREIGHT TRAFFIC.

	1.	2.	3.	4.
Causing low rates...	Long Distances	Large Shipments	Low Value of Goods	Competition
Causing high rates..	Short Distances	Small Shipments	High Value of Goods	Lack of Competition

PASSENGER TRAFFIC.

	1.	2.	3.	4.
Causing low rates...	Low Class Service	Long Distances	Suburban Traffic, Special Rates, etc.	Competition
Causing high rates..	HighClass Service	Short Distances	....	Lack of Competition

Under the column of freight traffic are shown four of the principal qualifications which tend to give a low-freight rate to any particular shipment of goods, and their opposites which tend to give a high rate. The value of the goods by weight is the chief factor determining the "classification," and second in importance is the size of the particular shipment.

The less the value and the larger the amount shipped, other things being equal, the lower will be the class. Thus coal will be in a lower class than coffee, and either will be classed lower in car-load lots than in smaller quantities. Then the longer the distance and the more competition the less will be the rate per ton-mile for any given "class" over any given piece of road. A similar explanation applies to the column under passenger traffic.

The article shows in an interesting manner, by a number of concrete examples, how a change in the character of the traffic in the direction indicated in the upper row in the diagram may lower the average rates, *viz.*, in passenger traffic a larger percentage of low-class service (2nd and 3rd class, limited tickets, etc.), more long-distance travel, more suburban traffic or more traffic between competitive points; and in freight traffic a larger percentage of cheap goods, more car-load shipments, more long-distance consignments, and more traffic between competitive points.

This does not affect the mathematical question which we have stated, but it does have a practical bearing on the more important ethical question, which is this: Has the reduction in average rates per ton-mile been at the expense of the railroad companies and a direct gain to the public, or does it consist merely in doing less work for less money? Does the average ton-mile represent a smaller service now than it did when rates were higher? The answer to this question requires an analysis of the items tending toward lower rates as illustrated in the upper part of the diagram.

Let us assume that the tariffs have remained exactly the same, and that the reduced average receipts per ton-mile are due to a change in the nature of the traffic,—then the answer to our second question depends on which of the four factors (under freight traffic) has been instrumental in reducing the revenue. If it be due to either (1) or (2),—larger shipments or longer distances,—it means that the cost of service is less, and the reduced rate is no loss to the railroad and no gain to the public. But if the reduced revenue is due to the transportation of more low-priced goods or more traffic between competitive points it is *not* accompanied by a diminished cost to the railroads, and is a gain to the customers. The higher rates previously charged, when the freight was valuable and competition absent, were high, not on account of a large expense of handling, but because, under the principle of charging what the traffic will bear, those goods were found to be able to bear a high charge. Now under the changed character of traffic no such relatively large quantity of freight is found which will bear such charges, and so the average has been lowered. Likewise in the case of passenger traffic, if the reduction is due to a larger proportion of low-class service or of long journeys it means a less expensive service, and is no gain to the public; but if it is due to more travel between places having low rates on account of competition or more suburban traffic it means a cutting down of the monopoly profits of the railroads, and is a gain to the public.

Now the examples given in Mr. Swain's paper show that the reduction in average rates has been due to the operation of both causes,— those which reduce the cost, and those which reduce the monopolistic power of the railroads. Just how much it is due to each, and how far it is a direct benefit to the customers, it would be difficult to determine. One fact which lies on the surface is that the low average freight rates per ton-mile in this country are due chiefly to the enormous amount of long distance freight traffic.